

Anatomy of external auditory canal a review

From otolaryngologist's perspective

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Authors

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Abstract

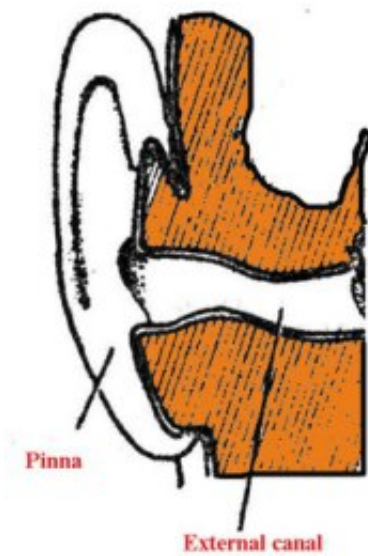
The external auditory canal is the only skin lined cul-de-sac in the whole human body. It is known to perform both auditory and non auditory functions. The auditory function is that it permits efficient sound transmission from the environment to the tympanic membrane, self maintenance of a clear passage for transmission of sound. Its non auditory functions include protection of the middle ear and inner ear from trauma and environmental insults. This article dwells in depth about the entire gamut of anatomy of external auditory canal.

Anatomy of external auditory canal a review

Introduction:

The external auditory canal is the only skin lined cul-de-sac in the whole human body. It is known to perform both auditory and non auditory functions. The auditory function is that it permits efficient sound transmission from the environment to the tympanic membrane, self maintenance of a clear passage for transmission of sound. Its non auditory functions include protection of the middle ear and inner ear from trauma and environmental insults ¹.

Fig. 1: Figure showing external auditory canal



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Embryology:

The external canal arises from the first branch

e mandibular and hyoid

arches². The first branchial cleft has a dorsal component while the ventral component results in the formation of first branchial cleft. By the fifth week of development, mesoderm gestation primary external meatus is formed. This primary meatus corresponds to the later surrounded by cartilage which is formed. Branchial groove thickens and grows medially to form a meatal plug or plate. This meatal plug remains solid until the 21st week. The meatal plug starts to hollow out when its inner cells start to degenerate. The external auditory canal is fully canalized by the 28th week⁵. The most medial cells of the epithelial plug become the outer layer of the tympanic membrane.

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nal canal arises from the first cleft. If the first cleft is in direct contact with the endoderm of the first pharynx. By the 8th week of development, it is directed towards the tympanic canal. This portion is derived from the ectoderm of the first branchial cleft. In the formation of a

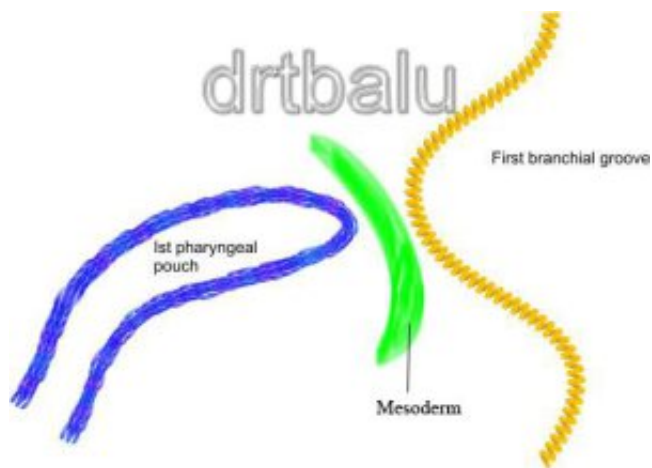


Figure showing coronal view of embryonic external auditory canal 6th week

Figure showing coronal view of embryonic external auditory canal 9th week F

At birth, the tympanic membrane, ossicles and otic capsule are all of adult size,⁶ but changes do occur to the external canal till about 9 years of age. In neonates the tympanic membrane and the squamous portion of the temporal bone form the roof of the external canal. The tympanic ring is not completely fused inferiorly, and a portion of the floor of the external canal is composed of the non ossified lamina fibrosa. The tympanic ring is completely fused inferiorly by the second year. Complete ossification of the lamina fibrosa is completed by the third or fourth year. Failure of complete ossification in the anteroinferior canal results in a bony gap known as the foramen of Huschke. The shape of the external canal in a neonate is nearly straight. By the age of 9 the external canal has elongated and nearly of adult size.

Anatomy:

The adult external canal is divided into an outer cartilaginous portion in its outer 1/3 and bony portion in its inner 2/3. It measures about 2.5 cms on the whole. The postero superior wall of the external canal measures 25 mm whereas its antero inferior wall is slightly longer i.e. measuring about 31mm because of the antero inferior inclination of the ear drum. The cartilaginous section of the external canal is angled postero superiorly, while the bony canal is inclined antero inferiorly. These angulations give the canal a s shaped course. The cartilaginous canal can be straightened by pulling the pinna postero superiorly enabling better visualisation of the ear drum.

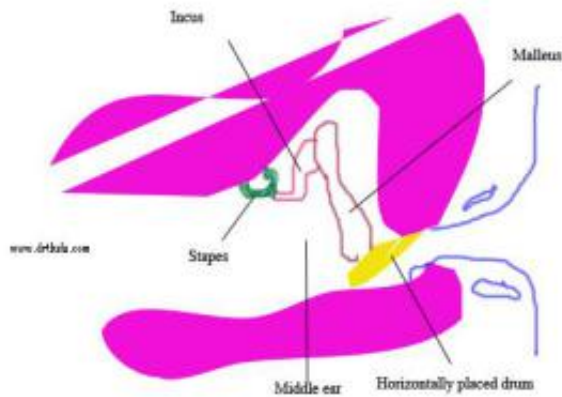


Figure showing coronal section of external canal of an infant. The ear drum is nearly horizontal forming the medial portion of external canal

The condyle of the mandible and glenoid fossa produce a convexity in the anterior bony canal wall limiting the visualisation of the ear drum. This prominence and the depth of the anterior tympanic sulcus predispose foreign body entrapment in the antero inferior portion of the medial end of the external canal. The narrowest portion of the external canal is at the bony cartilaginous junction. The volume of the external canal is about 0.85 ml².

The outer third of the external canal is surrounded by an incomplete cylinder of cartilage. This cartilage is deficient in its superior portion. This defect is bridged by dense fibrous tissue that is attached to the squamous portion of the temporal bone. Laterally this cartilagenous portion is continuous with the conchal and tragal cartilage. This cartilage is attached medially to the bony canal wall with dense connective tissue. In the cartilagenous portion antero inferiorly are two horizontal fissures in the cartilagenous canal termed the fissures of santorini. These fissures render more flexibility to the external canal. It also serves to allow infections and tumor to pass between the external canal and the parotid gland.

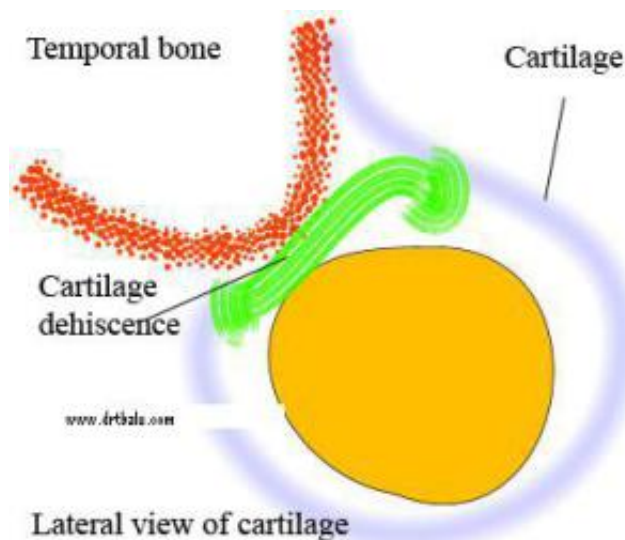


Figure showing the orientation of external auditory canal cartilage

The bony canal is composed of a complete cylinder of bone extending laterally from the ear drum. The

anterior and inferior walls are composed of the tympanic portion of the temporal bone and the superior and posterior walls are formed by the squamous and mastoid portions of the temporal bone. A bony ridge, the tympano mastoid suture line is evident in the posteriorinferior portion of the canal wall during surgical procedures like elevation of the tympanomeatal flap.

Blood supply of external auditory canal ⁷:

Laterally supplied by the post auricular and superficial temporal arteries. Medially it is supplied by deep auricular artery which is a branch of first portion of the internal maxillary artery. This deep auricular artery supplies the tympanic vascular ring. Veins from the external canal drain into the superficial temporal and post auricular veins. The post auricular vein connects to the sigmoid sinus via the mastoid emissary vein, this anastomosis provide a route for infections of the external ear to spread to the intra cranial cavity.

Lymphatics generally follow the veins and drain into the parotid group of nodes ².

Sensory Innervation:

Since it originates from branchial arch it is innervated by 5th, 7th, 9th and 10th cranial nerves. Auriculo temporal branch of the mandibular nerve innervates the anterior portion of the pinna, tragus, and the anterior wall of the external canal. The wall of the concha and the posterior wall of the external canal receive innervation from the 7th, 9th, and 10th cranial nerves. This complex innervation of the external canal accounts for several clinical findings involving the external canal : i.e. vesicular eruption in the skin of the external canal with facial palsy is caused by herpetic infection of the geniculate ganglion is known as the Ramsay Hunt syndrome. Hypesthesia of the concha and external canal caused by facial nerve compression from cerebello pontine angle tumors is known as Hitselberger's sign. Instrumentation of the external canal can cause nausea or coughing through stimulation of the vagus nerve via the Arnold's nerve.

Histology:

The external canal is lined entirely by keratinising stratified squamous epithelium. This epithelium is in continuity with the lateral surface of the tympanic membrane. There is marked differences in the morphology of the skin as one progresses from medial to lateral in the external canal. The skin lining the bony canal is very thin, measuring about 30 – 50 microns in thickness. The rete ridges are absent in the skin lining the bony portion of the external canal. The skin here also lacks hair and other appendages. The skin here is loosely adherent to the underlying bone, facilitating easy elevation during surgery.

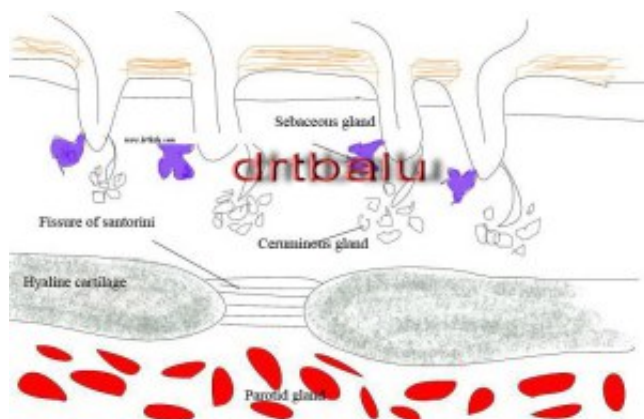


Figure showing the histology of skin lining the cartilaginous portion of external canal

The skin over the cartilaginous canal is much thicker and more adherent than the skin of the bony canal.

It has numerous hairs as well as sebaceous and ceruminous glands. There are no eccrine sweat glands in the external canal. The skin lining the external canal is the only keratinising epithelium that lacks eccrine glands. The hairs are most numerous at the lateral end of the canal, becoming less numerous medially and totally absent from the bony cartiagenous junction.

The sebaceous glands are simple or branched alveolar glands emptying their secretions in the the base of the hair follicles. These glands are infact not capable of active secretions but they form their secretion by passive breakdown of cells.

Ceruminous glands are modified apocrine sweat glands. There are approximately 1000 – 2000 ceruminous glands in an ear. These glands are tubular and have ducts that open either into hair follicles or directly on to the skin surface. The individual ceruminous gland is a simple coiled tubular gland. The glandular epithelium is cuboidal or columnar and has secretory buds extending to the lumen of the tubule.

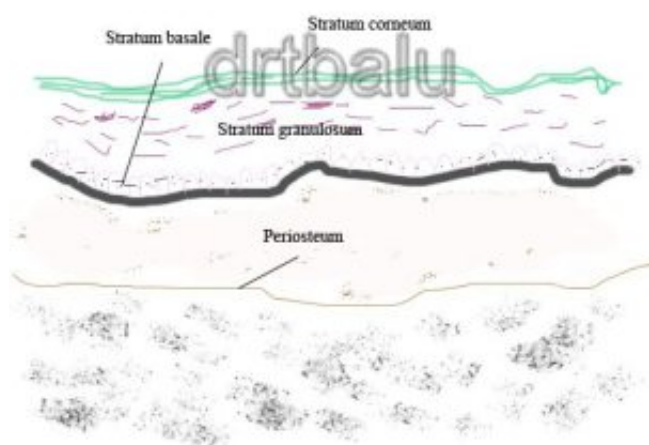


Figure showing histology of deep canal wall skin

The external canal provides ideal condition for growth of microorganisms because of its warmth, darkness, moisture, and presence of debris and nutrients. Hence it could even be termed as a skin lined culture tube. The normal flora of the external canal is stable and show no significant difference with regard to sex, climate or season etc.

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